On-farm tree planting in Malawi

Article

Accepted Version

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Context

Rural households historically obtain most of their complementary inputs and saleable commodities from nearby areas of forest and woodland (Arnold, 1997a). As the area of cultivation expands, the natural woodland declines so that pressure on these areas increases. Farmers do not, however, clear their land completely of trees. Chosen species are left on the farm during land clearance, and more trees may be left as land use pressure increases (Bewket, 2003; Kaimowitz, 2003; Reij and Smaling, 2008). These remaining trees tend to be managed in a more intensive fashion. On-farm tree management increases with population/agricultural intensification; from passive management, where forest cover is locally abundant, to intensively managed home gardens, where trees are completely integrated into a farm household's agricultural strategy and farmers raise seedlings in their own tree nurseries. These more intensive systems can be identified by both the number of trees found on the farm and by increasingly complex and labour intensive methods of tree propagation (Ajayi *et al*. 2011; Garrity *et al*. 2010).

Integrating trees into farming systems brings many potential benefits for farmers (Garrity *et a*l. 2010; Kalaba *et al*. 2010); products from agroforestry include fuelwood, fruits, building poles, timber, medicines and fodder for livestock, while physical benefits include shade, protection against soil erosion, improved soil fertility and boundary demarcation. The advantages that can be gained from on-farm tree planting are social, economic and biological. However, there are also a number of constraints that farmers must consider when contemplating the integration of trees onto their farm. These include land, labour, capital, market access and cultural issues/attitudes. In analysing the management of these systems, it is important to understand the needs of the local people, which are often ignored or not sufficiently well understood (Kaimowitz, 2003; Mercer, 2004).

Malawi

Natural resource management is a major issue in Malawi and throughout sub-Saharan Africa. Smallholder farmers, who make up 80% of Malawi's rural population, play a key role in both the protection and exploitation of their natural resources through their varied livelihood strategies. Malawi is one of the most densely populated countries in southern Africa, making the management of natural resources a challenging task, particularly as the unimodal rainy season creates pressure on the timing of rain-fed agriculture and the planting/management of trees.

Methods

Field sites

The target population for the study was taken from three field sites (Neno, Ntchisi and Rumphi) covering the three regions of Malawi. These sites were chosen for their location (south, central and north), their similarities in terms of topography and climate (each experiencing a unimodal rainy season) and their varying population density, which helps to highlight a trajectory of intensification. Each of the districts has smallholder subsistence

farming at its core, with maize as the staple food crop; and each employs similar farming methods.

The data required to address the issues regarding on-farm tree planting are both qualitative and quantitative. The economic, cultural and social dimensions that are intrinsic to this mean that multiple methods were employed and discipline boundaries crossed to gather relevant data. A range of data collection methods were used, including a questionnaire survey, in-depth farm case studies (involving a farm transect, a farm map, a timeline, an agricultural calendar and an in-depth interview), focus groups and interviews with key stakeholders. The adoption of this mixed approach realised the strengths of both quantitative and qualitative data collection methods, strengthening the evidence base.

Farm typologies

Whilst the quantitative data highlighted clear and distinct differences between the sites, there are nevertheless a large number of similarities that exist among individual farms across them. These inter-site similarities made it difficult to separate entirely the three sites and to un-pick any more subtle links between agricultural intensification and tree planting/management. In order to examine these inter-site similarities in more detail households were categorised into four new farmer groups based upon analysis of their social and economic characteristics (using principal components analysis, hierarchical clustering and discriminant analysis), so that more nuanced links can be made between tree planting/management and socio-economic characteristics.

Key Findings

What trees are planted on farms?

Many of the trees kept on the farm are indigenous species (the 10 most popular species are shown in table 1). These are either left standing when the land is cleared for cultivation or naturally germinate and are left to grow; others are transplanted, either from the local woodland or, in some cases, from other parts of the farm where their presence is considered to be less advantageous. Farmers plant some species directly from seed, whilst others, often exotics, are planted in nurseries before being transplanted onto the farm. The process of nursery cultivation is evidence of an intensive form of tree husbandry.

Table 1: Most popular tree species and proportion of farms on which they are found

Species	Total
Mangifera indica	95.2
Musa paradisiaca	89.0
Psidium guajava	84.2
Eucalyptus spp.	82.2
Citrus sinensis	56.2
Gmelina arborea	52.1
Faidherbia albida	51.4
Carica papaya	47.3
Senna siamea	40.4
Toona ciliata	33.6

The rationale of on-farm tree planting

Farmers perceive trees and their benefits/uses in different ways which affects the way that they interact with them dependent upon the type of species and its use. Some of the benefits that can be gained from trees such as firewood and other woody resources are not seen to be connected to the farm as they are collected from the natural woodland. Farmers are unlikely to plant trees solely for firewood (as discussed by Warner (1997)), as this would require a large shift in the way that they perceive this resource. Indigenous species are left on the farm when it is cleared for cultivation and may well be transplanted when found naturally germinating in the field, however, they are unlikely to be planted from seed or raised in a nursery (with the exception of *Faidherbia albida*).

Exotic species are more likely to be planted and more likely to be raised in a nursery. In some cases, this may be due to their commercial potential. Similar to the perceived differences between indigenous and exotic species, there are differences in a farmer's perception of commercial and non-commercial species. Planting for commercial purposes can be distinguished from planting trees that are for the benefit of the farm in the long term (for future generations). Although it isn't hugely expensive, investment of labour, time and money into planting trees may require relatively swift and direct returns.

Constraints and opportunities

Aside from the main constraints of land, labour, capital, market access and cultural issues, farmers highlighted issues linked to resources. As farmers prioritise their crops ahead of their trees (with many struggling to find the resources just to take care of their crops), a major constraint proved to be the timing of planting. Farmers like to plant trees early in the rainy season, the key time for maize cultivation. Despite the conflict in labour resource, many farmers were clear that they would devote resources to planting trees if they were able to source seeds/seedlings in good time. Alongside this, farmers discussed a number of other problems: a lack of polythene tubes in which to grow seedlings, problems with pests, the potential for theft (mainly for firewood in areas where the natural woodland is in short supply) and a lack of appropriate education and extension.

Agricultural intensification and on-farm tree planting in Malawi

Throughout the research, farmers were clear that there are more trees being planted than in previous years, most linking this with the decline in natural resources. However, it is clear that the decline in natural woodland is not the only driver behind enhanced on-farm tree planting. Commercial farming (tobacco) in Rumphi and Ntchisi appears to encourage farmers to plant and manage trees to provide poles for their own use and, in some cases, to take advantage of commercial opportunities. Fruit trees in Neno provide income for households. Farmers see trees as being an alternative to fertiliser in helping to improve yields in Ntchisi and Rumphi where increased pressure on land has prevented fallowing and farmers are planting trees to protect their land from soil erosion. Farmers see the opportunity to save money, make profits and to improve and protect their land using trees.

The triggers for increased tree planting/management are complex and vary with individual households. It is quite a jump in consciousness for farmers to re-configure natural resources as farmed crops, however there does appear to be a general trend of increased tree planting/management alongside agricultural intensification. Three of the four farmer groups were found to be integrating trees into their agricultural strategies. For a household to increase the intensity of their tree planting it seems that one or more of the appropriate

facilitating factors must be in place: the appropriate resources (both financial and labour supply), some contact with commercial markets, seeds or seedling supply, increased pressure on land, knowledge of techniques and benefits, willingness and ability to diversify and take risks, security of tenure and the desire for specific benefits.

This is highlighted by the differences between households in farmer group 2 (figure 1) and farmer group 4 (figure 2). The negative factors that constrain the households in group 2 (elderly heads, small workforces, lack of interaction with markets) outweigh the positive factors of their relatively large farms and the increased security that they receive from their long and settled tenure.

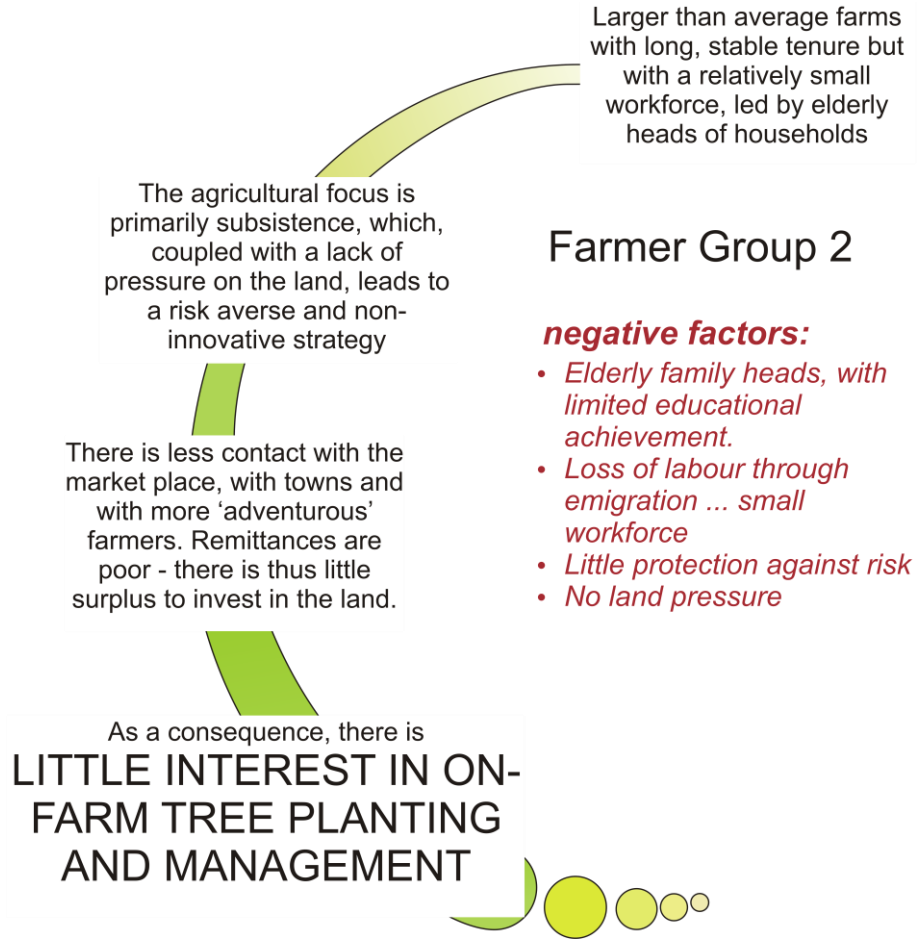

Figure 1: Factors influencing tree planting/management: farmer group 2

This is in contrast with the more intensive tree planting/management by farmers in group 4 (figure 2). Farmers in group 4 are relatively well educated, young, have access to financial resources (allowing them to invest relatively heavily in their farm) and a larger workforce (giving them a buffer against any shocks). Farmers in group 4 have increased knowledge of propagation techniques and appear more willing to diversify, using trees for a multitude of benefits.

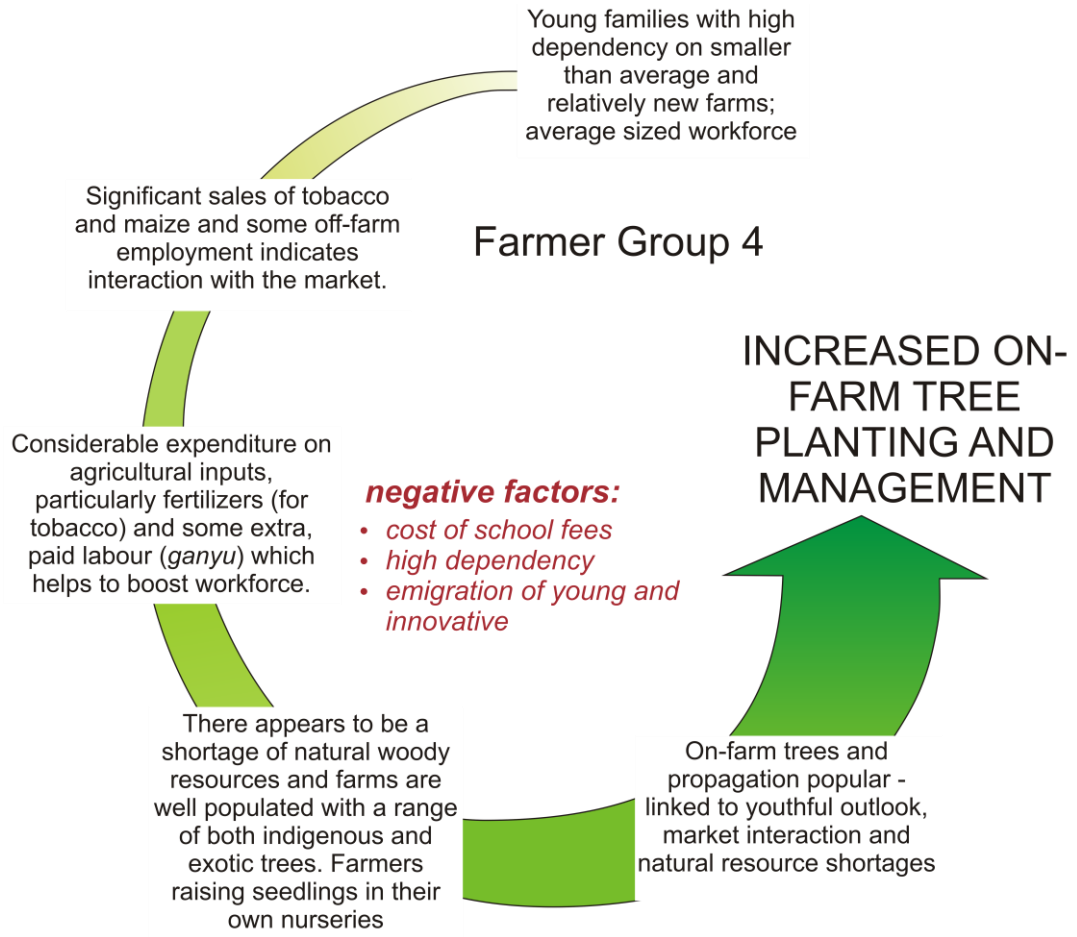

Figure 2: Factors influencing tree planting/management: farmer group 4

Why do many agroforestry programmes seemingly fail and what lessons can be learnt from these programmes?

It is clear that a large number of farmers in Malawi are keen to integrate trees onto the farm for a number of different reasons, whether to provide firewood, poles, fruit, soil fertility, shade or to demarcate the boundaries of their land (amongst others). Whilst some of these farmers are keen for trees to play a key role in their agricultural strategies and are directly managing them, others take a more passive approach. The socio-economic issues behind these differing approaches to tree management need to be understood before agroforestry interventions are considered. The benefits that trees can provide a household, with relatively small costs, make them attractive options for governments and development organisations. However, as Arnold (1997b, p. 283) asserts, too many interventions have either "*sought to encourage tree growing where trees are not an appropriate component of the farm household economy, or have attempted to induce growing of inappropriate trees*".

Agroforestry interventions must take account of the fact that there are "*different kinds of tree users and that the purposes for which trees are planted might vary not only with the type of tree but also with the type of user*" (Arnold 197b) suggesting that a single recommendation never will be a realistic goal. Agroforestry research and intervention requires an action research based approach, where a potential programme is only rolled out once practitioners have a full understanding of a community, tailoring potential programmes to suit the participants and the environment in which they live. Farmers will plant and manage trees

only in so far as they address and hopefully satisfy a clearly felt need; and not as part of a 'beneficial' programme devised by technical experts from the outside – simply on the basis that trees are 'good'.

Conclusion

The unimodal rainy season experienced by farmers in Malawi makes tree growing a less attractive option than in other parts of sub-Saharan Africa, however, this does not stop farmers from integrating trees into their agricultural strategies. Farmers have historically left trees on their farms when clearing land for cultivation and have allowed selected naturally germinating species to prosper on their farm; however, a more managed strategy appears to emerge under increased pressure on the farm (through either increased commercial influence or increased population pressure). Alongside this increased pressure, the social and economic circumstance of a farmer influences their approach to tree planting/management on their farm. For a household to increase the intensity of their tree use, it seems that one or more appropriate facilitating factors must be in place. Rigorous consideration should be given to the social and economic circumstances of farmer groups before tree based interventions are rolled out, in order to identify both the drivers for increased tree planting/management and a clear and specific need for achievable goals.

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